FOURTH CONTRIBUTION TO THE HISTORY OF THE FAUNA OF THE MIOCENE AND EOCENE PERIODS OF THE UNITED STATES.

By E. D. Cope.

ESCHRICHTIUS, Gray.

Eschrichtius polyporus, Cope.

Species nova.

Character. Ramus mandibuli with coronoid process but little elevated; form compressed with narrowed acute superior margin, which is not flattened posteriorly. On its inner face a wide shallow groove, in which the inner series of foramina lie. Foramina of outer series large, numerous. Size large.

Description. This whale, from the form of the ramus mandibuli, is a finner, and from the slightly developed coronoid process, allied to the humpbacks. The coronoid, the anterior position of the dental foramen, and the angular process, confirm these relationships. Whether it be a Megaptera or Eschrichtius I am not prepared to state. Ear bullae of the forms of both these genera occur in the strata in which the present species was found, and future investigation must determine which are referable to the latter. Such a bulla of the form of and probably belonging to, Megaptera, has been named *Balaena mysticetoides*, by Emmons. (North Carolina Geol. Survey Tab.)

The fragment which on the present species is based, is the proximal two-fifths the left ramus mandibuli, with a considerable part of the condyle. The direction of the shaft from a short distance anterior to the coronoid process, is decurved. The inferior margin is slightly contracted below the coronoid process and then for a short distance convex, and narrowed into a ridge; anteriorly it is most obtuse or convex transversely. The inner face is plane at the coronoid process, the outer convex. Anterior to this point the convexity is strong; at the distal end of the fragment, much less marked.

The angular process has extended beyond the line of the condyle; its extremity is broken away. A wide groove separates it from the base of the condyle on the inner face of the ramus. The surface of the condyle is transverse to the plane of the ramus, and is strikingly elevated above the portion of the ramus anterior to it, being as high as the tip of the coronoid process. A low knob projects on the inner face of the ramus beneath its anterior part, and below the groove. The dental foramen is large, and is overhung by the thin incurved superior margin of the ramus. Its anterior margin terminates just behind the posterior part of the base of the coronoid process.

The pores of the inner series are small and numerous; the last one is a little anterior to the base of the coronoid process (34 lines). They are situated in a wide shallow groove, which occupies a portion of the inner face of the ramus below the upper edge. Their interspaces are not quite equal; thus twenty lines separate two, and four are included in thirty-

six lines. The foramina of the external series are more numerous than in any of the other species from the Miocene of our Eastern States. As in others the last pairs are less spaced than the anterior. In a space of six inches and twenty lines, there are six foramina, the third from behind nine lines below the superior margin. Thirty-four lines separate the anterior pair; twenty-two the posterior. The last foramen is about a half an inch anterior to the plane of the last one of the inner side.

	Feet.	Lines.
Length of fragment	2	42
Depth just behind coronoid		56
" " in front of coronoid		66
" at fourth inner foramen		62
Diameter " " "		27

This ramus chiefly resembles that of Eschr. cephalus from Maryland. It is less compressed, though crushed, and less attenuated on the upper margin near coronoid process; the coronoid process considerably smaller. Outer series of pores more numerous and extending further back. Inner in a marked groove, which is wanting in E. cephalus. Outer wall of angular region more everted. Inferior wall of dental or mandibular canal descending from margin of foramen in E. cephalus and ascending in E. polyporus.

From the Miocene Marl of Edgecombe Co., North Carolina. Obtained by the writer under the auspices of the North Carolina State Geological Survey, under Prof. Wm. C. Kerr, Director.

Vertebræ, which as to size and structure would accord with the present species, are not uncommon in the same deposit; their description is reserved for a future occasion.

MESOTERAS, Cope.

Genus novum.

Character. Orbital process of frontal narrowed, exceedingly thick and massive at the extremity. Posterior lumbars and anterior caudals with short antero-posterior diameter. Premaxillary and maxillary bones depressed, the latter thin, horizontal, narrow. Otic bulla compressed.

This genius is allied to Balaena in the form of its vertebræ, and to some extent in that of its frontal bone. The flatness of the maxillary and premaxillary is rather that of Balaenoptera. The extraordinary mass of the superciliary portion of the frontal is peculiar to the species which forms the type of the genus so far as known.

Mesoteras kerrianus, Cope.

Species nova.

This species was discovered by Prof. Wm. C. Kerr, Director of the Geological Survey of North Carolina, in a bed of miocene marl, at a point where it is cut by Quanky Creek, a tributary of the Roanoke river, in Halifax county, North Carolina. A portion of the cranium had been noticed for some years projecting from the steep bank or wall of the small cañon of the creek, at about thirty feet below the surface of the ground.

Prof. Kerr, with the aid of a number of men, dug from its bed and elevated to the surface of the ground a large fragment of the cranium, including the greater part of the left maxillary and premaxillary bones, with a large part of the frontal. A large fragment of the right ramus of the mandible, an otic bulla, several lumbar and caudal vertebræ, with several broken ribs, were also obtained.

These remains indicate not only a species, but a genus new to science, and the largest extinct Balænoid yet discovered.

The principal mass includes from the posterior margin of the transverse process of the frontal, to within four or five feet of the end of the muzzle. The mass measures eleven feet six inches in length. The fragment of the ramus mandibuli measures thirteen feet; five feet are probably lost distally, and there is no trace of coronoid process at the point where it is broken off proximally. The length of the restored cranium would not be less than eighteen feet. This gives for the total length, estimating on the basis of Megaptera, seventy-five to eighty feet.

The orbital process is nearly in line with the maxillary, probably in consequence of pressure when lying in an oblique position. The whole cranium has been injured from the same cause, and the matrix usually soft, formed a solid investment of carbonate of lime from the carbonic acid liberated during decomposition, which required several days' labor to remove. The parietal, occipital, and other bones of the brain-case proper, were not recovered.

Description. The upper surface of the muzzle is but little decurved anteriorily. A portion of its outer margin, at the posterior part, is preserved, so that its width is known. The maxillary forms a rather thin lamina, and does not present any great median decurvature, as though the vomer was not prominent below. Perhaps this peculiar flatness is partly due to pressure, but the *premaxillary* presents a similar character, which is evidently normal. This element forms one margin of the mass, and the question as to whether the exposed face were the outer of the right, or the inner of the left bone, required some care for its solution. Anteriorly it is three inches in depth, near the posterior extremity, two inches. The greatest width near the middle, six inches. The margin next the remainder of the mass, is rather the more elevated; the external somewhat prominent and rounded. Beneath it a deep groove marks apparently the exit of a foramen. A groove in the same line is seen at various points throughout its length where exposed. This bone is thus much flatter than in any of the Finner whales, and resembles more that of the right whales. The outer face being nearly plane, it can scarcely be the vomerine face, which is concave, especially so in Balæna, for the accommodation of the cartilaginous axis. The foramina and grooves are equally present in both these genera, on the external side; I therefore conclude that the external side of the right premaxillary is the one exposed, and that the width of the muzzle includes the left premaxillary, and maxillary. The suture between the latter is not distinct, owing to the presence of longitudinal fractures. The width of the maxillary after the premaxillary

is deducted, is not great, and is intermediate between that seen in Balaena and Megaptera. The right premaxillary may be traced for six feet two inches. Behind it a portion of the superficies of the cranium slopes towards the position formerly occupied as a blow hole.

The margin of the *maxillary* is horizontal, and rather thin. It becomes thicker posteriorly where it has been crushed back on the lateral orbital process of the frontal. Its acuminate extremity is seen lying on the latter.

The orbital process of the *frontal* is remarkably massive, and might at first be taken for the squamosal. Its posterior margin is free to within a foot of the probable position of the blow holes. This fact, in connection with its deep postero-inferior concavity in cross section, is conclusive as to its relations. The form is not horizontally expanded as in Megaptera, nor attenuated as in Balæna, but has rather the proportions seen in Reinhardt's figure of the young of Balæna mysticetus. (Om Nordhvalen Pl. III.) That is, it has subparallel anterior and posterior sides; the extremity a little widened by the production backwards of the posterior portion. The anterior portion also somewhat, though less, protuberant. The whole extremity truncate and remarkably thickened. Thus it is nineteen inches long, the anterior tuberosity seventeen inches deep, the posterior twelve inches deep ; the inferior outline nearly straight. The orbital concavity, which is continuous with the optic foramen, opens behind the posterior tuberosity, and is defined exteriorly by the expanded posterior margin of the bone. Thus the great tuberosity which gives character to the bone was above and in front of the eye.

The portion of the *mandible* preserved presents marked characters. The inner face is slightly concave, or plane, the external strongly convex. The inferior edge is narrowed, and the superior scarcely less so ; the inner face rounds a little to the former, and to a wide groove just below the latter. This groove is one inch wide near the middle of the ramus, and is marked by a series of many small foramina. These are closer together in the anterior, and regularly more widely spaced to the posterior portion. Thus anteriorly they are 2.5 inches apart ; posteriorly four inches separates them, and near the extremity of the series, six inches. I failed to find any foramina on the external face of the ramus. It is difficult, however, to believe that they are totally absent ; it may be that they are confined to the anterior portion, which has not been preserved. This peculiarity, if entirely established, marks the species as quite distinct from any heretofore known from characters of the mandible. The depth in this species, at the point where the foramina are four inches apart, is fourteen inches.

There are some other pieces apparently belonging to the cranium, whose exact positions I cannot now assign. One of these looks like a segment of ramus of the lower jaw, but the convergence of the superior and inferior outlines is too great. One face is plane-concave, the other convex flattened, with oblique superior and inferior faces, the latter the widest. Depth of plane, ten inches; do. exterior flattened face, 7.75 inches. Depth

six inches from same point, 7.5 inches. The second uncertain fragment is long and with parallel margins. The outer face is strongly convex; the inner, at one extremity concave, so that a section would be half a crescent (the lower portion being lost). The inner face gradually becomes convex, though not strongly so, and the long diameter is transverse, while it is vertical at the anterior end. The former is seven inches; the latter eight inches. The fragment looks like the extremity of a premaxillary bone, possibly a maxillary, but it is scarcely appropriate to the premaxillary already described.

The periotic bones of the left side were preserved almost entire. The bulla has the flat inferior face of the genus Balæna, and the periotic processes are exceedingly short, shorter even than those of the species of Balæna (B. mysticetus and B. cisarctica). The external process is not longer than the posterior, and is compressed and deeply grooved longitudinally below. The posterior process is at right angles to the exterior, and as broad as long. It bears a sublongitudinal ridge near the middle of its inferior face; anterior to it, separated by an interval a transverse ridge occurs to which the edge of the thin lip of the bulla is attached. The anterior process contains the usual foramina, and is broader than long. The superior face of these bones is quite rugose. The bulla is more flattened, *i. e.*, has a shorter vertical diameter, than either that of Balæna mysticetus or B. cisarctica. The circumference is not a sharp edge as in B. cisarctica, but is truncate and rugose, at the inner extremity most so. At the external extremity the face gives way to a rounded edge. The inferior face is coarsely impressed punctate, and has a curved depression inside the anterior margin. The posterior margin is marked by the usual three grooves with intervening enlargements. The general outline, viewed from below is hexagonal, with the lengths of the sides as follows, beginning with the longest; posterior, anterior, interior, postero and antero-exterior equal, antero-interior very short. The bulla of B. cisarctica exhibit a long posterior and long interior side, connected by an arched outline.

The vertebræ are those of the genus Balæna. The general form of the centra of anterior lumbars and caudals, is abbreviated, especially the latter. The diapophyses of the former are thick at the base; one of those preserved may be a posterior dorsal, but the ends of the diapophyses are not preserved. In a caudal with very short diapophyses, which are a little nearer the basis of the chevrons than that of the neural arch, a small foramen penetrates the centrum from a point three inches above the base of the diapophysis, and issues at a point 2.5 inches below it. The articular faces are convex; there is a small rugose central area, and an external annular space with coarse concentric ridges.

Measurements.

	Ft.	In.	Lin.
Length of fragment of O. maxillare to extremity which reposes on frontal	9	8	
Width of same (with left premaxillary) at 42 inches from extremity		16	

	In.	Lines.
Transverse diameter periotic bulla	5	8.7
Longitudinal	4	9.5
Vertical	3	1.5
Length external periotic process	1	9.5
" posterior " "	2	2
Length centrum anterior lumbar No. 1	10.75	
Vertical and transverse diameter do. each	12	
Width neural canal	5	
Length diapophysis	17	
Width do. at base	7	
" " " middle	6	
Length centrum lumbar No. 2	10.5	
Both diameters of articular face	13.	
Width neural canal	5.5	
" antero-posterior neural spine	5.	
Length centrum of a caudal	6.5	
Diameter articular face, (vertical)	14.	
" " (transverse)	14	6
" neural canal	1.5	
" inter-chevron groove	3	

As compared with the described species, the characters of the Mesoteras kerrianus are well marked. Thus the ear bone is totally different from that of Eschrichtius cephalus and E. mysticetoides (*Balæna* Emmons, Leidy), and the mandibular ramus is not flattened above, as in E. priscus and E. expansus. The paucity or absence of external foramina distinguish it from the E. polyporus. Finally, E. leptocentrus presents generic characters in its known cervical vertebræ which will not probably be found in the present whale. Though these vertebræ of Mesoteras have not yet been found, I anticipate that they will present more nearly the characters of the genus Balæna, in accordance with the remainder of the structure. Perhaps they will be like those of Palæcetus of Seeley, and the two genera may be found to be the same.

It has been known to geologists and others for some time, that a skeleton of some kind had been exposed by the erosive action of the waters of a creek in Eastern North Carolina, and was to be seen lying in its bed diagonally across it. The writer recently visited the spot, and found the stream to be some fifty feet in width, containing water of from three to five feet in depth. The direction and extent of the skeleton was indicated by the proprietor, Jesse W. Parker, since the water concealed it from view. It would appear to extend very nearly across the creek, and have a length of 60 to 70 feet. Some of the vertebræ could be distinguished by feeling with a rod. When the waters are low towards the end of the summer, its length is exposed, and it can be used as a foot log by the traveller. On the bank near this skeleton were found portions of the skeleton of an adult firmer whale of some thirty feet in length.

Prof. Kerr, Director of the survey, succeeded in obtaining one or two of

the lumbosacral vertebræ of the specimen which is above noticed. These were submitted to me at Raleigh. They belong to a right whale, or one nearer to Balæna than Balaenoptera. They are in fact identical in character with those of the species Mesoteras kerrianus, and belong probably to it. The following is a description of one of them from the posterior dorsal or anterior lumbar region.

Median line below, obtusely keeled, sides a little concave. Articular face with a large median elevated area, which is coarsely obsoletely rugose; the marginal area exhibits fine concentric rugosities.

Measurements.

	Inches
Length centrum	7
" basis of diapophysis	4.5
Depth " "	3.25
" articular face	8.5
Width " "	9.
Thickness of epiphysis	.75

The epiphyses are free and the individual is young.

A vertebra of similar character to, and rather larger size than any here described, was obtained by the writer near Nahumta, Wayne Co., N. Ca. The species would not appear to be rare.

This whale is named for Prof. Wm. C. Kerr, of Raleigh, who has vitalized the State survey, and is prosecuting it with advantage to all branches of science that lie within its scope.

SUS, Limaeus.

Sus ?sp.

Represented by the crown of an inferior posterior molar of an animal not fully grown. Both extremities are broken off, but sufficient remains to indicate the genus of the animal beyond doubt.

The two principal lateral and adjacent median tubercles of the tooth present the characters of the same parts in the *Sus scropha*, and indicate a species of about the same size. A section of each lateral lobe is therefore slightly trifoliate, and the two inner ridges, whose sections constitute the lobes, are transversely deeply wrinkled. The margins of the broader outer lobes are also wrinkled, the wrinkles sometimes continued into shallow grooves on the outer face of the same. The convex outer face is marked by delicate concentric linear grooves, the apex of the lobe being the centre of the arcs. The anterior and posterior median tubercles are much the same as in *S. scropha;* in the former the crown is nearly three times as wide as long, as in *S. scropha.* The posterior median tubercle is sub-trilobed, and a little broader than long; surfaces of both tubercles rugose plicate. A pair of shallow longitudinal grooves on the outer face of each lateral tubercle.

The inferior face of the crown presents a not uncommon peculiarty in the isolation and deep conic form of the prolongations of the pulp cavity, which correspond to the tubercles. In another specimen which I refer to the *S. scropha*, these prolongations are connected by grooves which enclose diamond-shaped interspaces.

	M. M.
Width crown at base,	0.0163
" between apices lateral tubercles,	.007
Length, including median tubercles,	.014
" anterior median tubercle,	.003
Width " " "	.008

This is one of the interesting discoveries made by Dr. Lockwood, of Keyport, N. J., in the fossiliferous strata of his region. He obtained it of a farmer, with a number of other fossils of the upper marl bed in Monmouth Co., N. J. The farmer used the marl of that stratum as manure, and probably found the present specimen while digging it. The color of the tooth is black like that of other Miocene and Eocene fossils of that region, and though on application to a flame it shows the existence of a small amount of carbonaceous organic matter, it does not give out the odor perceived in the post-tertiary bones of New Jersey, when burned.

Recently, my friend, Oliver N. Bryan, sent me from Stafford Co., Virginia, a similar posterior molar from the inferior series of a hog. On contact with a flame it evolves such an odor of organic matter, and combustion leaves such distinct traces of carbon, that I am unwilling to consider it a fossil. It is stained of a strong red color, which does not penetrate far below the surface as does the black in the specimen above described. Its posterior median tubercle is accompanied by a smaller tubercle on the inner side; behind it an opposed pair of rudimental proportions follows, and as the crown narrows to a sub-acute termination, a still lower median tubercle finishes the series. The anterior extremity of the tooth is broken away. In these unused crowns, the edges of the tubercles are crenate, and the inner and median lobes and tubercles are coarsely plicate.

THINOTHERIUM, Cope.

Family *Hippopotamidæ*. Dentine thrown into transverse ridges on the basal half of the second inferior incisor, otherwise probably as in Hexaprotodon, or with three superior incisors at least.

This genus is indicated by a second inferior incisor of the right side. It resembles that of the genus Hippopotamus, but differs in the annulate character of the surface of the dentine of the proximal portion of the fang. The worn exterior face near the extremity, indicates the friction of the usual large second superior incisor, while a corresponding worn surface on the opposite side of the extremity, indicates the presence of the inner or third superior incisor characteristic of Hexaprotodon and not found in Hippopotamus. The base of the fang exhibit the usual short pulp cavity, and is compressed, not rounded, as in Hippopotamus and Chœropsis, as though there were an additional, or third inferior incisor also. Apex of tooth narrowed obtuse.

Structure of dentine concentric.

Thinotherium annulatum, Cope.

Species nova.

Second inferior incisor slightly curved both outwards and upwards. Section of basal half, a vertical oval; beyond the middle, at worn surfaces,

quadrangular, with one angle upwards and the extero-inferior side convex. This is occasioned by the presence of a third flattened side, besides the two worn faces, at right angles with the interior worn face. It presents a short longitudinal groove, which may be abnormal. Extremity narrowed, sub-round, obtuse. The direction of the outer worn surface is outwards and backwards.

	M. M.
Total length,	0.0543
Vertical diameter at base,	.0117
Transverse " "	.0075
" " near tip,	.006

The color of the tooth is dark red, and it has not penetrated far into the dentine. On application to a flame, a very faint odor of organic matter may be perceived, and a slight trace of carbon may be detected. The surface is considerably worn, so that it cannot be determined whether there was a coat of enamel originally or not. It was discovered in Stafford Co., Virginia, at the same locality from which the molar of the hog above described, was procured. They have both been rolled, and are both of a red color.

The Thinotherium annulatum was a small Hippopotamus-like animal, about the size of the wild boar. As it was no doubt like its recent allies, a shore-and-swamp-loving beast, I name it from $\theta\iota\nu$ the shore, or $\theta\eta\rho\iota\acute{o}\nu$, a wild animal.

The discovery of the Hippopotamus in America, by O. N. Bryan, and the hog, by Dr. Lockwood, is of considerable interest. Neither types have been heretofore known in either extinct or recent condition (except as introduced), and are, therefore, not included in Leidy's recent Synopsis of Fossil Mammalia of North America, in the Journal Acad. Natl. Sciences, Phila. De Castro, in an essay entitled, "De la Existencia de la grandes Mammiferos Fossiles en la Isla de Cuba," Havana, 1865, states that remains of Hippopotamus occur in the Island of Cuba, referring them to an extinct species. Leidy remarks on this,* that they are probably recent, and cites examples of specimens used for making artificial teeth by dentists, having been brought to him as fossils.

MYLIOBATIS, Cuvier.

MYLIOBATIS GLOTTOIDES, Cope.

Spec. nov.

Established on three specimens, one of which presents a series of eight teeth very convex in longitudinal as well as transverse direction. On the median line the teeth are suddenly swollen, forming together a broad obtuse median ridge. The lateral portions on either side are each slightly convex, and thin off to a margin which embraces but a single series of lateral teeth. Each transverse tooth is nearly straight, the extremity slightly and abruptly curved backwards. Each tooth is both wider (longer) and deeper than in most of the described species. The worn surface forms a subtriangular concavity.

* Proceed. Acad. Nat. Sci., Phil., 1868, 179.

	Lines.
Length of eight teeth over convexity	41
" of stoutest tooth	6.3
Depth of vasodentine of do	7
Width of same tooth (over convexity)	28

Laminar face obtusely angulate on the median line below.

This species is thick-toothed as in M. pachyodon and M. holmesii, but they are not so clearly three-ribbed in section as this one. The M. rugosus is somewhat similar, but is much wider, with more curvature of teeth and double row of laterals.

From the marl pits of the Freehold and Squankum Company, in the Eocene bed at Farmingdale, Monmouth Co. N. J.

MYLIOBATIS RECTIDENS, Cope.

Represented by seven consecutive teeth extending from the concave triturating surface, to the end of the series. There are two lateral series of teeth on each side, of which several of those of the inner series at least are wider than long. Those of the median series are entirely plane, and with perfectly straight transverse sutures. The series is very slightly convex in both directions.

	Lines
Length of seven teeth	38
Width of each median tooth	15
Depth of vasodentinal layer	4

This species is to be compared with the M. vicomicanus m. In it there are twice as many (12) teeth in a series of the same length and width as the present; the median series are recurved at the extremities; in this one straight.

This species is from Harrisonville, N. J., from marl excavations which are chiefly in the upper bed of Cretaceous green sand. The rusty color of the specimen indicates that it came from the upper part of the excavation, and therefore probably from a miocene stratum which Prof. Cook shows frequently overlies the green sand proper.

COELORHYNCHUS, Ag.

COELORHYNCHUS ACUS, Cope.

Established on a portion of the muzzle of a fish similar in some respects to the C. rectus, Ag., but smaller than it and much less than the C. ornatus, Leidy, from the same locality. The fragment presents a single median cavity, and externally nineteen ridges separated by narrow grooves; in the C. ornatus there are from thirty to forty in the same portion of the length. Diameter 1.3 lines. From the Eocene Marl of Farmingdale, Monmouth Co. N. J. I am indebted to A. J. Smith, Superintendent of the pits, for this and other valuable specimens.